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Performance measures: Traditional versus new models

Hasan Zafer Yuksel

PERFORMANCE MEASURES: TRADITIONAL VERSUS NEW MODELS

A Thesis

Presented to the

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California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Business Administration

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by

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ABSTRACT

This thesis analyzes the performance of 5,987 mutual funds using a database "Steele Mutual Fund Experts" and compares the predicting ability of various measures of performance. The measures discussed in the thesis are Treynor Ratio, Sharpe Ratio, Jensen's Alpha, Graham-Harvey-1 (GH-1) and Graham-Harvey-2 (GH-2). The performance measures are mostly used by professional money managers and scholars for literary purposes.

This thesis establishes that Treynor's Ratio and Jensen's Alpha lead to more optimistic results than Sharpe, GH-1 and GH-2. For positive beta, Treynor's Ratio and Jensen's Alpha yield the same result for all categories of mutual funds but these findings are challenged when funds have the negative Beta. Finally, contrary to claim that GH-1 and GH-2 are different from all traditional performance measurements such as Sharpe, GH-1 & GH-2 do not exhibit superior or different results than Sharpe.

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CHAPTER ONE

BACKGROUND

"As of April 2006, there are 8,606 mutual funds with combined assets of $9,207 trillion dollars invested actively managed mutual funds" - http://www.answers.com. This figure shows the significance of mutual fund industry in U.S.A. and explains why so many scholars have attempted to evaluate the performance of funds managers.

The purpose of this graduate thesis is to compare the predicting ability of the various measures of performance most commonly referred to in the literature and used by professional money managers such as Treynor (1966), Jensen (1968) and Sharpe (1966). In addition, this research will integrate the prediction power of a relatively new measure of performance, introduced by Graham and Harvey (1994, 1996).

To conduct this investigation, the data compiled from Steele Database was used. The Steele Database, also known as Steele Mutual Fund Expert, is a comprehensive reference source of mutual fund data. "Steele Mutual Fund Expert provides all sources of investment data for over 19,700 mutual funds, 41,000 variable annuities, and 350 market

indexes & investment objective averages between 1962 and 2006" - Steele Systems, Inc.

Literature Review

"The essence of performance evaluation is to measure the value of the services provided by the portfolio management industry. It investigates whether a fund manager helps enlarge the investment opportunity set faced by the investing public and, if so, to what extent the manager enlarges it" (Chen, Knez 1996). The evolution of portfolio performance has generated a great deal of interest in academic circles. Jack L. Treynor suggested a new predictor of mutual fund performance in 1966. This measure directly linked to concept of beta through the Security Market Line (SML) and used systematic risk to assess performance of funds. At the same time, William F. Sharpe (1966) attempted to extend Treynor's work by subjecting his proposed measure to empirical test in order to evaluate its predictive ability. Unlike Treynor's Measure, this new performance measure based on the Capital Market Line (CML) and approached the concept of performance by comparing the excess return and risk. Although Treynor (1966) and Sharpe (1966) defined risk, return, and performance differently, both measures have

found common usage among fund managers, practitioners and scholars because of their practical applications and simplicity. Later, in 1968, Jensen (1968) developed another performance measurement called Jensen's Alpha. This measurement based on the average return over and above (that) predicted by Capital Asset Pricing Model (CAPM). In his approach, the alpha represents a coefficient measuring the portion of an investment's return arising from specific (non-market) risk (Downes, Goodman 2003). Finally, J.R. Graham and C.R. Harvey (1996) analyzed the advice contained in a sample of 237 investment newsletter strategies over 1980-1992. They found no evidence that letters systematically increase equity weights before market rises or decrease weights before market declines. This study helped them construct new performance measures called Graham-Harvey Performance Measure 1 & 2.

Based on those performance measures, numerous studies have been conducted on mutual fund returns to investigate whether returns are generated by manager skill, momentum, cash inflows from investors, or market timing. For example, Gruber (1996) and Zheng (1999) have shown investors ability to predict mutual fund performance and invest accordingly. Wermer (2003) found that momentum

buying and flow-related purchasing of funds help produce positive multiyear performance for successful funds. While Sapp and Tiwari (2006) and Carhart (1997) found little evidence for funds consistently outperforming when they were adjusted for the momentum effect shown by Jegadeesh and Titman (1993), Yet, Chen, Jegadessh, and Wermer (1999) found evidence that actively purchased stock by funds outperformed the stocks fund actively sold by around 2 percent per year, but only found weak evidence for stock picking skills of funds with the best performance compare with those that have the worst performance.

Mutual Fund History

The first official US mutual fund is traced back to 1924 and the establishment of the Massachusetts Investors Trust for faculty and staff of Harvard University. The idea of pooling money existed long before this however. As early as 1774, the Dutch investment community formed a trust called Eendragt Maakt Magt or "Unity Creates Strength." The idea behind mutual funds has always been the same; pooling resources to allow small investors an opportunity to diversify, spreading risk across various countries and investments. The growth of capital markets and the development of new investment opportunities

allowed room for more mutual funds to emerge. Early mutual funds were almost entirely close-end funds, a fund offering a fixed amount of shares. The Massachusetts Investor Trust was the first to offer "open-end capitalization," allowing for the continuous issue and redemption of shares by the investment company at a price that is proportional to the value of the underlying portfolio." Open-end capitalization has become the prevailing model for mutual funds and a development that has probably led to its current success. (Rowenhourst 2004)

At the beginning of the 20th century, close-end funds continued to dominate the mutual fund industry. Information transparency was still very low at this point in history, leading to many cases of abuses by fund managers. As capital markets developed, information became more widely available largely due to regulation, like the Investment Company Act of 1940, which sought to curb the abuses. Capital began to become more readily available with better financial instruments to facilitate investing. Open-end mutual funds began to overtake closed-end funds, and invested in bonds, stocks and eventually indexes. Stocks have always been the primary investment of mutual funds, currently with over 50 percent of all fund assets,

but bonds and money market funds have always been a significant niche market the 1920s.

Index funds have a more recent history. In 1969, William Fouse and John McQuown began working on concept of an index model. Working for Wells Fargo at the time, they tried to develop an equal-weighted index of all equity securities listed on the New York Stock Exchange for the pension fund of Samsonite Corporation. The implementation of their idea turned out to be much more difficult than expected and the concept was abandoned in 1976. This failure caused a shift to a market-weighted strategy using the Standard & Poor's 500 Composite Stock Price Index.

Although it was hardly accepted wisdom at the time, articles began to be written highlighting the fact that funds were rarely outperforming the market. One such article was "The Loser's Game" in the Financial Analysts Journal (July/August 1975) by Charles D. Ellis, Managing Partner of Greenwich Associates. Ellis focused on the fact that 85 percent of institutional investors underperformed the S&P 500. A large part of this underperformance was due to the high costs of investing that was eating up 20 percent of the returns managers generated. Such evidence allowed Ellis to make the bold statement: "The investment management business is built upon a simple and basic

belief: professional managers can beat the market. The premise appears to be false."

Such strong statement caught the eye John C. Bogle, who had been following the case for index funds. Based on his research into mutual fund performance, Bogle was convinced that low cost mutual fund based on the S&P index would be a success. With the firm he founded, Vanguard, Bogle created the first index mutual fund modeled on the S&P 500 Composite Stock Price Index. (Bogle 2000)

Industry Overview: Open-End Mutual Funds

Since the creation of open-end mutual funds in the early 1900s, they have grown to dominate the mutual fund industry. Open-end mutual funds now account for $8.9 trillion of the $9.5 trillion invested with US registered investment companies. As a result of open-end fund dominance in the industry, this paper will primarily focus it is attention on the statistics and performance of the open-end mutual fund industry. (www.icifactbook.com)

Mutual funds are an extremely popular investment in the U.S.A. Globally, the U.S.A. has the largest mutual fund market. Of the $17.8 trillion invested in mutual funds worldwide, over 50 percent comes from the U.S.A. Ownership of mutual funds include 47.5 percent of all

households and amount to 20 percent of household assets (excluding real-estate) in 2005; compare that with only 8 percent of households investing in mutual funds in 1980. Investors now have plenty of different funds competing for there money, including approximately 8400 mutual funds, 600 closed-end funds, and 200 exchange-traded funds. Almost 60 percent of these funds are run by independent investment companies, the rest falling under the sponsorship of banks, insurance companies, broker-firms, and foreign companies. The impact of mutual fund capital is significant financing 23 percent of US corporate equity, 37 percent of commercial paper, 10 percent of corporate bonds, 8 percent of US treasuries, and 28 percent of municipal securities. The majority of these funds are controlled by investment companies making their role in controlling the flow of investment capital and managing the assets of millions of US investors a very substantial one. (www.icifactbook.com)

Mutual funds are primarily broken down into two types: load and no-load classes. Load classes were designed for investors who invest through a financial advisor. The load fees help pay for the financial advisors services. No-loads are for funds where investors don't use a financial advisor or compensate the advisor through some

other means. Managerial expenses fees have nothing to do with load fees and exist for both classes and vary between each fund. (www.icifactbook.com)

Load classes break down into three share classes, usually named A, B, and C. Class A shares pay advisor fees through a front-end load, which is a certain percentage of the sales price. In addition, 12b-1 fees are assessed annually to compensate the advisor for their work, usually a low percentage (0.25%) of the investor's holdings. Class B shares have no front-end load, but have higher 12b-1 fees and are back-end loaded, otherwise known as contingent differed sales load (CDSL). The CDSL requires that the shares be held for a certain period of time, often 6-7 years, and if sold prior to this date a fee will be assessed. After 6-7 years are passed, the shares usually convert to A shares and receive the lower 12b-1 fee. Class C shares have no-front end load, but have higher 12b-1 fees (1 percent) and have a small CDSL fee if sold within a year after purchase. C shares do not convert to A shares, so their 12b-1 fees do not have the potential to be reduced. The result is that over time C shares end up having a higher expense ratio than the other two classes if they are held for a long time. It is important to note that the load is going to pay for the fund's sales

force not the manager of the fund. So in reality these fees have nothing to do with how well the fund performs, but can have a large impact on the investor who is receiving a return on less money. (www.icifactbook.com)

No-load funds continue to be extremely popular because of there low expense ratios. Of the $192 billion of new inflows into mutual funds, $152 billion came from no-load funds. No-load funds, like the name states, have the advantage of no front-end or back-end loads. No-loads can still have 12b-1 fees but they cannot exceed a quarter of a percent. In essence, these funds are cutting out the middle-man and investors can deal straight with the investment company so that promotion and advertising fees can be lowered. (www.icifactbook.com)

No load funds can still be used by financial advisors that have another way of being compensated by their clients other than load fees.

Investors are continuing to show a predisposition toward mutual funds with low expenses and low turnover ratios. Over two-thirds of stock fund assets were held in funds that have a turnover rate below 50 percent, based on asset-weighted average, the average turnover for the last 30 years being 57 percent. Expenses are also on a being pushed downward as investors continue to prefer low

expense funds placing nearly 90 percent of stock fund assets in funds with a below average expense ratio. In 2005, stock fund expenses were 1.18 percent, well below 1980 fund expenses of 2.32 percent. Most of the decrease is a result of a decline in front-end loads, currently around 1.25 percent, down from around 5 percent in 1980. Also, many households are investing through employer sponsored retirement plans which often get their loads waived. No-load funds have also become popular helping to push average expenses lower. Furthermore, competition and economies of scale have worked to force mutual fund to find new ways to cut expenses in order to attract customers. (www.icifactbook.com)

In particular, international and money market funds account for much of the increase. This trend is not surprising as emerging stock markets made a strong showing in 2005, greatly surpassing returns of US stock. Since many investors continue to use historical trends to forecast future performance the move to international funds is predictable. One should note that 2006 returns for international funds have not performed well at all, most seeing substantial drops. As for money market funds, the Federal Reserve is also keeping a close eye on inflation with a fairly tight monetary policy, resulting

in rising interest rates through 2005 and only slowing in mid-2006. This has caused the yield curve to be fairly flat and sometimes inverted prompting most investors to invest in short term instruments like money market funds. Furthermore, money market yields continue to rise faster than bank deposit yields, prompting many to move their money. This is a recent trend considering the low interest rates and yield spreads from 2002 through 2004 which caused most investors to move their money out of money market funds into better performing areas. (www.icifactbook.com)

Mutual fund distributions have also seen a strong increase since 2002. Capital gains distributions to shareholders were $129 billion in 2005, a 50 percent increase over 2004 but still nowhere close to the returns of the late 1990s. Dividend distributions of $166 billion were also up 42 percent over 2004, returns approaching 2000's distributions of $186 billion. (www.icifactbook.com)

Mutual Funds Performance

The idea behind investing in mutual funds, as opposed to ETFs, indexes, or single stocks, is the investor's belief that fund managers are not created equal, and that

a good manager can consistently earn returns that surpass the market in general. This belief is so strong that between 90-95 percent of money is placed in actively managed funds, the rest being indexed funds and ETFs. Morningstar and Lipper are two agencies that provide for this group of investors by regularly ranking mutual fund performance making it easier to distill mutual funds down to the "top" performers. Magazines, such as Forbes and Money, regularly include profiles highlighting acclaimed managers and their secrets of success. So is money smart or dumb? (Kermer 2003)

As indicated in Literature Review, numerous studies are conducted on mutual fund returns to investigate whether returns are generated by manager skill, momentum, cash inflows from investors, or market timing. The results fail to conclusively decide as to whether managers have any measurable effect on fund returns. However, regardless of a manager's potential ability to beat the market, the general consensus is that after fees and taxes, fund managers rarely beat the market and almost never on a consistent basis. History shows us the index funds constantly outperform the majority of actively managed fund over longer periods. "The largest and most well-known index fund is the very first index fund, the Vanguard S&P

500 Index Fund. This fund, started by the Vanguard Group, nearly matches the returns of the S&P 500 Index, and over the last ten years it has beaten the performance of over 90 percent of all mutual funds." (Motley Fool) If only 10 percent beat the index over a 10 year period, it makes sense to invest in the market through index funds. Taking this farther, shouldn't everyone invest primarily in index funds instead of actively managed funds? "The answer is resoundingly no. In fact, if everyone indexed, capital markets would cease to provide the relatively efficient security prices ... All the research undertaken by active managers keeps prices closer to values, enabling indexed investors to catch a free ride without paying the costs." (Sharpe 2002)

These figures lead to the conclusion that index funds should continue to grow in value over time. However, investors will continue to try and prove the smart money theory by searching for mutual funds with an investing style that appears to beat the market returns on a somewhat consistent basis.

CHAPTER TWO

GENERAL DESCRIPTION OF PERFORMANCE MEASURES

This section describes the commonly used measures of performances used by the scholars and fund managers and introduces the new measures graham and Harvey (GH-1 & GH-2) the performance of which is discussed in the paper. All of the performance measures in this chapter are described by based on the original works of Treynor (1966), Sharpe(1966), Jensen(1968), Graham and Harvey(1998).

Treynor's Ratio

Treynor (1966) reported two major risks in a diversified fund. The risk produced by general market fluctuations also known as the volatility of the stock market and the risk resulting from fluctuations in particular securities held by the fund. He also pointed out important practical consequences of either or both of these risks namely:

(I) The effect of management on the rate of return on investments made in any one period is usually swapped by fluctuations in the general market. Depending on whether the general market condition is rising or falling during the period

in question, the more volatile funds (stock funds) will look better or worse than the less volatile funds. (Treynor 1966)

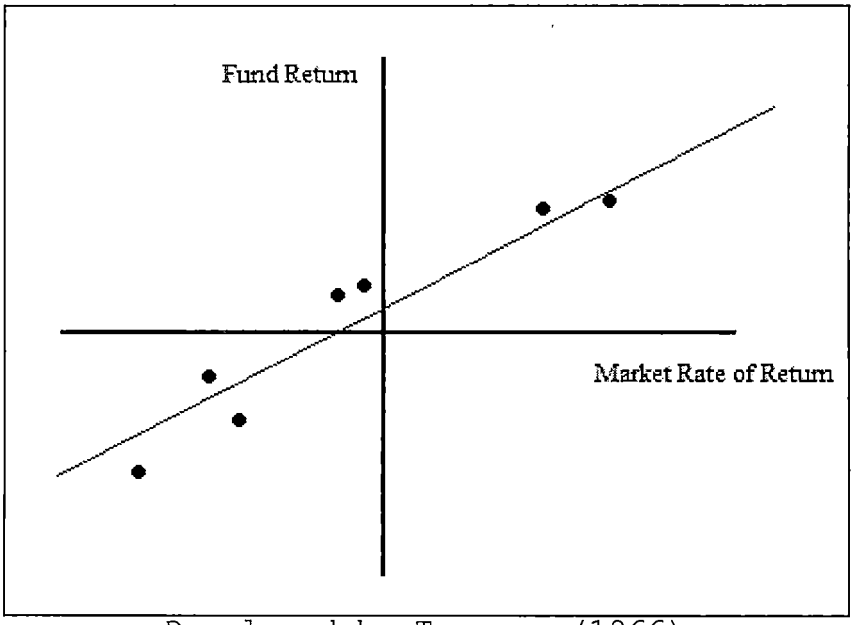
(II) Measures of average return make no allowance for investors' risk-aversion. The importance of fluctuations in one or a few stocks from the investor's point of view is apparent when one considers that, after all, if this kind of risk were not important, investors would not diversify. (Treynor 1966)

For these reasons, he offered a performance measurement method that remained constant provided management performance is constant, in spite of severe market fluctuations and taken into account the aversion of individual shareholders or beneficiaries to investment risk. The device for accomplishing this is the characteristic line (slope of this characteristic line represents Beta). (Treynor 1966)

To develop his measure of performance, Treynor selected four actually managed funds in the ten year interval ending January 1, 1963 and plotted their returns on a graph. The horizontal and vertical axes in these figures were measured in terms of percent rate of return[2]. The horizontal axis measured the corresponding rate of

return recorded for a general market average (the Dow-Jones Industrial Average); the vertical axis showed the rate of return for the fund. (Treynor 1966)

Treynor concluded that the funds exhibiting wide swings in the rate of return in each year fell into straight-line pattern which remained virtually fixed throughout the ten-year interval. He called this remarkably stable performance pattern over time when viewed in terms of the simple graphical device the characteristic line (or Beta) as depicted in Figure 1. (Treynor 1966)



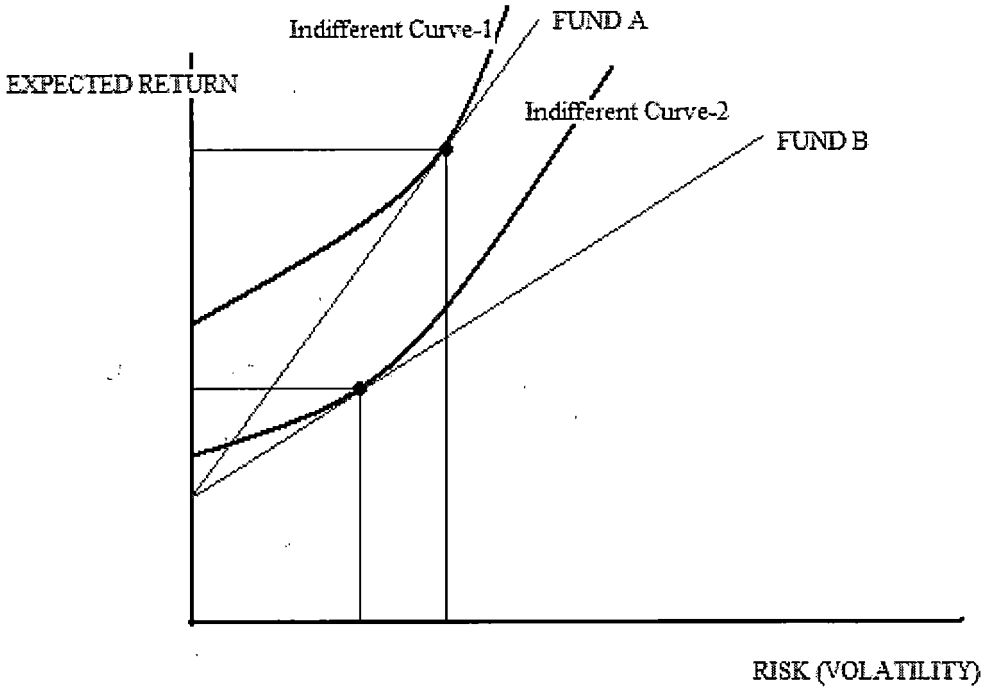
Developed by Treynor (1966)

Figure 1. Characteristic Line and Beta

This characteristic line contains information about expected rate of return and risk of the security. The slope of line (beta) measures volatility implying that a steep slope means that the actual rate of return for the fund is relatively sensitive to fluctuations in the general stock market; while gentle slope indicates that the fund in question is relatively insensitive to market fluctuations. (Treynor 1966)

The Figure also represents management's ability in obtaining a consistently higher return than the competitor's. However, different slopes are not sufficient to compare funds because it fails to consider an individual's risk preferences. If investors are more risk tolerant, they would prefer the risky funds with higher slope. (Treynor 1966)

However, Treynor uses investors' indifference curves for evaluating funds' performance so that excess return realized by the different funds can be calculated in terms of risk as depicted in Figure 2. (Treynor 1966)



developed by Treynor in 1966
Figure 2. Indifferent Curve and Treynor Ratio

Treynor's measure gives excess return per unit of risk, using the systematic risk. He formulated this ratio as follows;

$$\text{Treynor Ratio} = \frac{R_p - R_f}{\beta_p}$$

R_p = return of a portfolio,

R_f = risk free rate

β (Beta) = coefficient measuring a stock's relative volatility, or the covariance of a stock relative to rest of the stock market.

However, scholars were not satisfied with this measure owing to its accuracy and continued developing new performance measures to assess the accurate portfolio performance. *Sharpe's* measure resulted from this effort.

Sharpe's Ratio

Sharpe (1966) mentioned that "the empirical work on the behavior of stock-market prices supports the view that the market responds very rapidly to the new information affecting the value of securities". The scholars' expected reaction to these results was constructing a model of "perfectly informed market" where participants used the information in the manner suggested by portfolio analysis theory. The predicted performance of portfolio was described with two measures:

- expected rate of return (E_i) and,
- predicted variability or risk, denoted by standard deviation of return (σf). (Sharpe 1966)

There are several assumptions made under this analysis theory:

- All investors can invest funds at a common risk free interest rate and can borrow funds at the same rate (at least to the desired extent).

- All investors share the same predictions concerning the future performance of securities (and thus portfolios) at any point of time.

Following these conditions all efficient portfolios will fall along a straight line i.e.,

$$E_i = Rf + (RP) \times \sigma_i$$

Where,

E_i = expected rate of return, and

σ_i = the predicted variability of risk, measured by the standard deviation of return.

All investors were assumed to be able to invest funds at a common risk-free rate (Rf) and to borrow funds at the same rate. (Sharpe 1966)

Sharpe also stated that the results using this formula followed immediately from a relationship first described by James Tobin, namely, "If an investor can borrow or lend at some riskless interest rate Rf and/or invest in a portfolio with predicted performance, then allocating the funds between the portfolio and borrowing or lending they can attain any point on the line"[3] Using this argument any portfolio will give rise to a complete linear boundary of E-σ combinations. The best portfolio

will be the one giving the best boundary for which "$(E_i - R_f)/\sigma_i$" is the greatest. (Sharpe 1966) Implementing this argument in the previous equation, the modified equation becomes,

$$E = Rf + (Ef - Rf) * \frac{\sigma}{\sigma_i}$$

Where σ = standard deviation of portfolio on the efficient frontier, and

σ_i = standard deviation of the fund in the portfolio i

Also, If more than one portfolio is to be efficient, all must lie along a common line and give identical values of this ratio as shown in Figure 3. (Sharpe 1966)

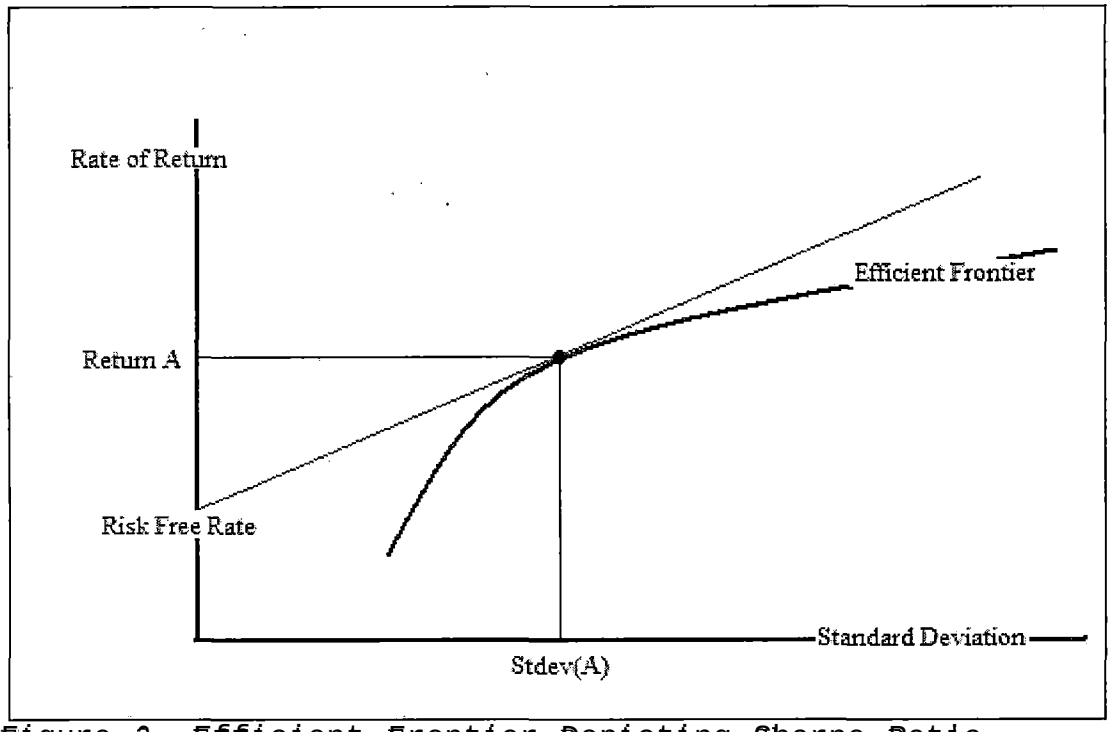


Figure 3. Efficient Frontier Depicting Sharpe Ratio

Jenson introduced a concept to evaluate the "performance" of portfolios of risky investments as central problem in finance. He then developed a measure to address this problem as discussed in the next section.

Jensen's Alpha

Michael C. Jensen (1968) divided the concept of portfolio performance in two distinct dimensions:

- ability of the portfolio manager or security analyst to increase returns on the portfolio through successful prediction of future security prices and,

- ability of the portfolio manager to minimize (through "efficient" diversification) the amount of "insurable risk" born by the holders of the portfolio. (Jensen 1968)

He stated that the major difficulty encountered in evaluating the performance measurement of a portfolio in these two dimensions has been the lack of a thorough understanding of the nature, and measurement of "risk." Evidences indicate prominence of risk aversion in the capital markets (Mintner (1965), Ferson (1989), and Ferson-Harvey (1991)), as long as investors correctly perceive the "risky-ness" of various assets. (Jensen 1968)

Based on the evidence, he addressed the problem of evaluating a portfolio manager's predictive ability to earn excess returns through successful prediction of security prices higher than expected level of riskiness of his portfolio. The model constructed is called "Jensen's Measurement" or "Jensen's Alpha." Algebraically:

$$\alpha_i = R_i - (R_f + \beta_i \times (R_m - R_f))$$

Where,

R_i = total portfolio return,

R_m = total market return,

R_f = risk free rate,

β_i = portfolio beta,,

α_j = coefficient measuring the portion of investment return arising from specific (non-market) risk.. (Jensen 1968)

Thus,, according to Jensen (1966),, if the portfolio manager has an ability to forecast security prices,, the intercept α_i (Alpha) will be positive.. Indeed,, it represents the average incremental rate of return on the portfolio is solely due to the manager's ability to forecast future security prices..

Finally,, in estimating α_i (Alpha) the measure of performance,, fund managers,, practitioners and scholars explicitly allow for the effects of risk on return as implied by the asset pricing model.. Moreover,, if this model is valid,, the particular market conditions over the sample or evaluation period has no effect whatsoever on the measure of performance. Thus,, Jensen's measurement (alpha) can be legitimately compared across funds of different risk levels and across differing time periods irrespective of general economic and market conditions. (Jensen 1968)

Treynor ratio,, Sharpe ratio and Jensen's alpha are three measures commonly used by the portfolio managers to

assess the performance of the funds in portfolios. However, traditional measures of the performance are not adequate for performance evaluation. Even Capital Asset Pricing Model (CAPM) measure has serious shortcomings. As Graham and Harvey (1998) mentions " In the CAPM environment, the manager's excess return is regressed on the market excess return. Roughly, the beta picks up the average level of market exposure. The alpha represents the extra return that the manager earns over and above a position with a (fixed) average market exposure. In the CAPM, the benchmark portfolio (beta times the market index) will have a different volatility than the fund. Using the CAPM, the fund volatility equals beta times the standard deviation of the market index return (the benchmark) plus the standard deviation of the idiosyncratic return."

They developed a new performance measure to solve these anomalies which are discussed next.

Graham - Harvey Performance Measures

The deficiencies mentioned above were overcome with the new measure of performance introduced by John Graham and Campbell Harvey. These measures are called 'Graham Harvey' measures.

Important Concept of 'lever" and "unlever" needs to be understood before discussing the details. For the purpose of understanding a mutual fund A is considered and its performance is evaluated relative to the S&P500 index.

Unlevering: Unlevering fund 'A' means reducing the volatility of this fund. This can be done by adding T-bills in the portfolio also known as "lending to T-bills".

Levering: levering is exact opposite of unlever where the volatility of portfolio is increased by investing money to the fund 'A' also known as "borrowing from T-bills".

Graham-Harvey Measure 1

In order to calculate Graham-Harvey Measure 1 (GH1) S&P 500 futures is levered or unlevered to have the exact same volatility as the fund over the evaluation period. GH1 is the difference between the fund return and the return on the volatility-matched Index or S&P 500 portfolio. (Graham, Harvey 1998)

The measure is depicted in figure 4 where funds over-performance and under-performance is shown. Two funds are considered here for this purpose, fund A and fund B. The efficient frontier is composed of S&P500 and Treasury bills (or T-Bill). T-bill is used to lever or unlever the

funds and S&P500 is used as market index. The volatility of funds A and B are matched to that of S&P500 to evaluate their respective performances (relative to S&P500 index). (Graham, Harvey 1998)

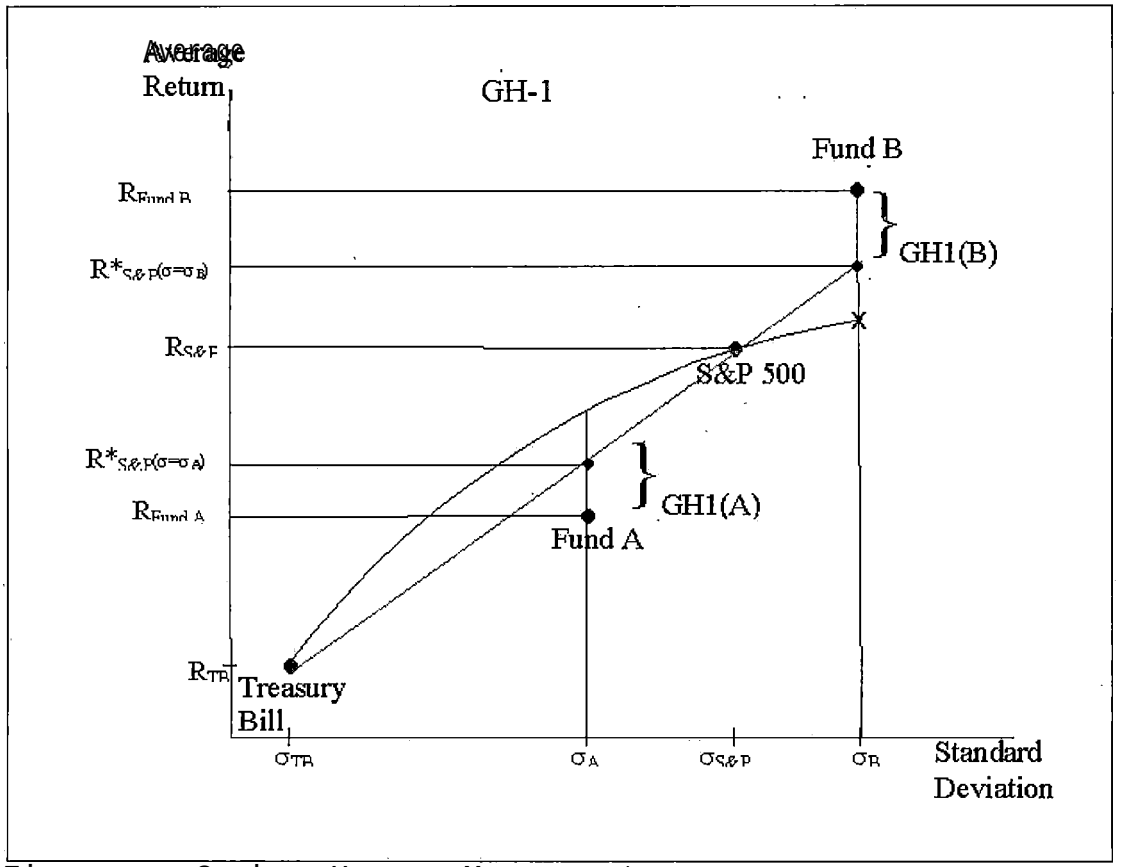


Figure 4. Graham-Harvey Measure 1

As shown in Figure 4, a strategy is used to unlever the S&P 500 by combining the S&P 500 with the Treasury bill to match the volatility of Fund A. After unlevering S&P500 has higher return than Fund A. Hence, GH1 for Fund

A is negative indicating underperformance. However, levered S&P500 has lower returns than Fund B. Hence GH1 for Fund B is positive indicating over-performance. (Graham, Harvey 1998)

To put the above discussion in simpler context if for example the investor had a target risk aversion (measured by level of volatility) equal to Fund A, then the investor would be better off holding a fixed weight combination of S&P 500 and T-bills than holding the fund. However, if investor has higher level of risk aversion, holding Fund B would be profitable as compared to holding a fixed weight combination of S&P 500 and T-bills. (Graham, Harvey 1998)

GH2 provides a different approach for evaluating the performance of a fund. In this measure the considered fund is levered or unlevered (instead of S&P500). To answer the evident question, why, Graham- Harvey say that "the two measures provide different perspectives. Over the evaluation period, Measure 1 just draws an efficient frontier using the S&P and cash and checks to see if the fund lies above or below this constructed frontier. The volatility matching approach displayed in Figure 1 compares the fund return to that for a volatility-matched benchmark over the exact same sample period. Measure 2 compares all funds to a common level of volatility - the

S&P 500 buy-and-hold volatility. All funds are on the same footing with GH2. The only potential disadvantage of GH2 is that it assumes the investor has the ability to lever an investment fund return to have the same volatility as the market." (Graham and Harvey, 1998)

Graham-Harvey Measure 2

The Graham-Harvey "Measure 2" (GH2) is related to GH1. The difference being, in this measure the fund's recommended investment strategy is levered up or down (using T-bill), to match the volatility of S&P 500. (Graham, Harvey 1998)

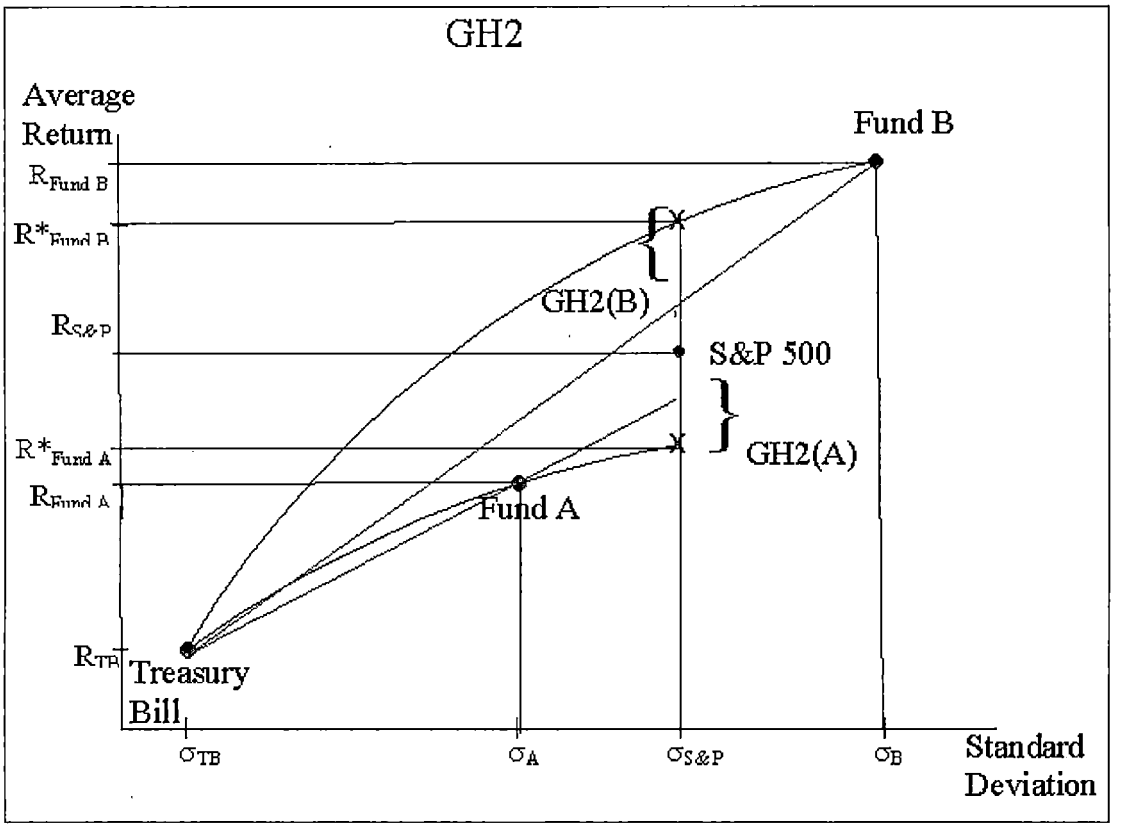


Figure 5. Illustration of Graham-Harvey Measure 2

After levering Fund A (to achieve the same volatility as the S&P 500) it can be seen that Fund A's average return is lower than a simple S&P 500. Thus, the GH2 measure is negative. On the other hand, if Fund B is levered down (by combining the fund strategy with a cash investment) to achieve the same volatility as the S&P 500, the unlevered fund return is greater than the S&P 500 and the performance measure is positive. (Graham, Harvey 1998)

Advantages and Disadvantages of Performance Measurements

Treynor's Ratio

Treynor ratio measures a fund's excess return relative to the risk which is assessed by Beta. However, this ratio is faced with several limitations:

- Treynor ratio fails to quantify value added decisions (change of strategies, management etc.) if any, of active management. It is a ranking rate only.
- The mutual fund and Market index ought to be correlated with each other in order to estimate Treynor's Ratio. Therefore, the R-squared statistic of the mutual fund is to be checked to make sure it correlates with the index (R-squared close to 100) (www.cupoffinance.com).
- Treynor Ratio is not an accurate measurement of performance for less diversified portfolio because less diversified portfolio consists of identical systematic risk, but different total risk will be counted same. However, the portfolio with higher unsystematic risk is less diversified and therefore has a higher

unsystematic risk which is not priced in the market (www.cupoffinance.com).

- Treynor Ratio is subjected to the same limitations as beta, and is only as accurate as the correlation between the mutual fund and the relevant market index. This is because the investments with low correlation to the equity market have betas that are not very meaningful and should not be relied upon (www.cupoffinance.com).

  For instance, beta has limited predictive reliability for any single security over short time periods; it is highly useful as a forecasting tool over long periods for well diversified equity portfolios, like most mutual funds.

In summary, Treynor Ratio is used for comparing different portfolios with a similar benchmark, since Beta is required in the calculation. However, Treynor ratio fails to provide useful results for comparing portfolios in different asset classes.

Sharpe's Ratio

Sharpe Ratio takes into account both the expected differential return between two portfolios and the

associated differential risk. Since the Sharpe ratio gives risk estimates before decisions are actually taken, it can be useful for decision-making, particularly, for choosing appropriate investments. Apparently, Sharpe Ratio performs better than the Treynor Ratio and Jensen's Alpha because:

- Sharpe Ratio is based on standard deviation which is calculated the same way for any type of mutual fund or security, and is not tied to a benchmark index (i.e. S&P 500) (www.cupoffinance.com).
- Sharpe Ratio can also be used to compare the risk-adjusted returns of stock funds against bond funds, or any other security. However, the same cannot be done with the Treynor ratio or Jensen's Alpha (www.cupoffinance.com).

In a well diversified portfolio, Treynor and Sharpe Ratio can be used interchangeably because; the unsystematic market risk (non-market risk) is eliminated in well diversified mutual funds. On the other hand, with a less diversified portfolio, portfolios with identical systematic risk will be rated the same. But the portfolio with a higher total risk is less diversified and therefore has a higher unsystematic risk which is not priced in the

market. For non-diversified mutual funds, the Sharpe Ratio is the more accurate than Treynor Ratio.[4]

Some of the disadvantages of Sharpe Ratio are:

- Like the Treynor Ratio, the Sharpe ratio does not take any value-adding decisions into account.
- Sharpe ratio presupposes that each prospective investment's return is uncorrelated with the return to an existing portfolio. As Sharpe himself acknowledges, "the Sharpe ratio may not give a reliable ranking if one or more of the assets involved is correlated with the rest of our portfolio" (Sharpe 1994, pp. 54-56 and Improving Sharpe Ratio, by Kevin Dowd, 2000).

Jensen's Alpha

Jensen's Alpha is the average return on the portfolio over and above that predicted by the CAPM, when the portfolio's beta and the average market return are given. As with the Treynor Ratio, Jensen's Alpha is only as good as the benchmark. However,

- Mutual fund and the index ought to be correlated with each other in order to calculate Jensen's ratio. For this reason, the R-squared statistic of the mutual fund is checked to make sure it

correlates with the index (R-squared close to 100) (www.cupoffinance.com).

- The estimation of Jensen's alpha may be biased due to market timing, defined as fund managers' ability to systematically change the target risk of the fund (Jensen, 1972; Admati and Ross, 1985; Dybvig and Ross, 1985). When portfolio managers change the target beta for the fund by moving money among different investments, estimation bias will be introduced into the benchmark model because it assumes a constant beta coefficient over the period under study. (Murthi, Choi, Desai, 1997)

Graham-Harvey Measure 1 and Graham-Harvey Measure 2

As mentioned earlier, GH-1 adjusts volatility of market index (S&P 500) to match the volatility to the fund evaluated. On the other hand, GH-2 adjusts volatility of the fund to match the volatility of market index (S&P 500) by using T-Bill. Table-1 provides information distinguishing GH-1 and GH-2 from traditional performance measurements.

Table 1. Traditional versus New Measures of Performance

Traditional Measures	New Performance measures
In CAPM, the manager's excess return is regressed on the market excess return. Also, the fund volatility equals beta times the standard deviation of the market index return (the benchmark) plus the standard deviation of return.	GH1 adjusts market variance to have same variance as the fund.
beta indicates average level of market exposure and, alpha represents the excess return earned over and above a position with a (fixed) average market exposure.	GH1 exactly matches the total volatility of the fund with market index hence providing accurate results than beta or alpha.

However we do not live in the perfect world; GH-1 and GH-2 have some disadvantages as well which are discussed as follows:

- They are relatively more complex than widely-used traditional performance measurements.
- Graham and Harvey measures were introduced assuming that volatility of T-bill never equals zero. Therefore, the capital allocation line which is composed of S&P500 & T-Bill (or Fund & T-bill) is expected to be curvilinear. However, levering or unlevering of S&P500 depends on the

ratio of (σ_i/σ_m) for GH-1. (σ_i/σ_m) basically indicate slope of a straight line, thus, either overestimating or underestimating performance of the funds. Same is the case with GH-2-where (σ_m/σ_i) ratio is used to assess performance of the fund.

- GH-2 assumes that the investor has the ability to lever or unlever an investment fund return to have same volatility as the market. However, this is difficult and almost impossible in some cases (Graham and Harvey, 1998).

CHAPTER THREE

METHODOLOGY

This section describes the data set used and the procedures followed to tabulate, analyze and compare performance measure of the funds. Also, the formulas used the calculate Sharpe, Treynor Ratio, Graham-Harvey 1 and Graham-Harvey 2 are described in detail. For the comparison purpose, the graham Harvey measure is calculated along with Sharpe ratio, Treynor ratio and Jensen's alpha. The calculated values are then analyzed to assess fund's performance.

Data Magnitude

Data used in this thesis was obtained from the Steele Mutual Fund Expert. This data includes 5987 observations during the period April 1996 to March 2006. the thesis makes these observations for mutual funds which are categorized by their types into Asset Allocation, Convertible, Equity, Fixed Income, Index and Money Market. Each type is analyzed in 1-, 3-, 5- and 10- year period. Since each type of mutual funds mentioned above have different characteristics, the data is split using this categorization. Table-2 shows the data used for the thesis.

Table 2. Types of Funds Used for Study

Type of Funds	Count	Percentage
Asset Allocation	363	6.06%
Convertible	37	0.61%
Equity	2210	36.91%
Fixed Income	2159	36.06%
Index	331	5.52%
Money Market	887	14.81%
Total	5987	100%

Type of Funds

This section defines each type of mutual funds and also covers brief introduction about them.

Index Mutual Funds

"Index Funds are mutual funds that have the portfolio matching that of broad based portfolio. This may include the Dow Jones Industrial Average, Standard & Poor's 500 Index, indices of mid- and small-capitalization stocks indices, and bond indices, to name a few. Many institutional and individual investors, especially believers in the efficient market theory, put money in index funds on the assumption that trying to beat the market averages over the long run is futile, and their investments in these funds will at least keep pace with the index being tracked. In addition, since the cost of

managing an index fund is far cheaper than the cost of running an actively managed portfolio, index funds have a built-in cost advantage". (Downes, Goodman, 2003, Dictionary of Finance and Investment Terms, Barron's, 6th Ed., 327)

Equity Mutual Funds

"Equity mutual funds invest primarily in stocks. The stocks a fund buys – whether in small, up-and-coming companies or large, well-established firms – depends on the fund's investment objectives and management style. The general approach is implied by the fund's name or the category to which it belongs, such as large-cap growth or small-cap value". (www.pathtoinvesting.org)

Asset Allocation Mutual Funds

"Asset Allocation Mutual Funds can be described as the mutual funds that switch between stocks, bonds, and money market securities to maximize shareholders' return while maximize shareholders' returns while minimizing risk". (Downes, Goodman, 2003, Dictionary of Finance and Investment Terms, Barron's, 6th Ed., 35.)

Such funds have become extremely popular recently since they relieve individual shareholders of the responsibility of market-timing (their entry or exit into

different markets), since the fund manager is making those decisions on their behalf.

Theoretically, asset allocation funds provide "a built-in buffer against declining stock and bond prices because the manager can move all the fund's assets into safe money market instruments. On the other hand, the manager has flexibility to invest aggressively in international and domestic stocks and bonds if he or she sees bull markets ahead for those securities". (Downes, Goodman, 2003, Dictionary of Finance and Investment Terms, Barron's, 6th Ed., 35)

Convertible Mutual Funds

Convertibles Mutual Funds can be defined as the mutual funds investing predominantly in convertible bonds and convertible securities. "Convertible preferred shares or bonds can be exchanged for a set of predetermined number of another form, usually common share, at a pre-stated price"- http://www.venturechoice.com.

Convertibles are appropriate for investors who want higher income than is available from common stock, and have higher appreciation potential than regular bonds. From the issuer's standpoint, the convertible feature is usually designated as a sweetener, to enhance the marketability of the stock or preferred stock (Downes,

Goodman, 2003, Dictionary of Finance and Investment Terms, Barron's, 6th Ed., 35).

Fixed Income Mutual Funds

"Fixed income Funds are the mutual funds that invest in government, corporate, or municipal bonds, which pay fixed rate of interest until the bonds mature. These funds also invest in preferred stock, paying a fixed dividend. Such investment are advantageous in a time of low inflation, but do not protect holders against erosion of buying power in a time of rising inflation, since the bondholder or preferred shareholder gets the same amount of interest or dividends, even though consumer goods cost more." (Downes, Goodman, 2003, Dictionary of Finance and Investment Terms, Barron's, 6th Ed., 259)

Money Market Mutual Funds

"Money Market Funds are the mutual funds that invest in commercial paper, banker's acceptances, repurchase agreements, government securities, certificates of deposit, and other highly liquid and safe securities, and pays money market rates of interest. Many money market funds are part of fund families. This means that investors can switch their money from one to another and back again without charge". (Downes, Goodman, 2003, Dictionary of Finance and Investment Terms, Barron's, 6th Ed., 327)

Data Analysis

To assess the return characteristics of each particular subcategories (Index, Money Market, Asset, Fixed Income, and Equity), Monthly Return (R_{it}) is calculated using data from Steele Database. Annualized Return (AR_i) is then calculated using the monthly returns. Monthly Return indicates the total return of mutual fund over the period from April 1996 to March 2006.

The equations used in this paper can be divided into 4 sections:

- Average Return
- Annualized Return
- Annualized Standard Deviation and Beta Coefficient
- Performance Ratios

Average Return:

$$\overline{R}_f = \frac{\sum_{t=1}^{T} R_{ft}}{T} \quad \text{..... (1)}$$

$$\overline{R}_i = \frac{\sum_{t=1}^{T} R_{it}}{T} \quad \text{..... (2)}$$

$$\overline{R}_m = \frac{\sum_{t=1}^{T} R_{mt}}{T} \quad \text{..... (3)}$$

Where,

T = the number of monthly return.

Equations (1), (2), and (3) indicate the average monthly return of Risk Free Rate, Mutual Funds, and Market Indices (S&P 500) respectively. Return of Risk Free Rate, Mutual Funds and Market Indices are collected from Steele Mutual Fund Expert.

Annualized Return:

$$AR_i = \frac{\sum_{t=1}^{T} R_{it}}{T} \times 12 \qquad \text{.. (4)}$$

$$AR_m = \frac{\sum_{t=1}^{T} R_{im}}{T} \times 12 \qquad \text{.. (5)}$$

Where,

T = number of observations,

Annualized Return of Funds and Market indices are calculated by using equations (4) and (5). Annualized return basically is multiplication of Average Return with 12.

Annualized Standard Deviation and Beta Coefficient (β):

$$\sigma_i = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(R_{it} - \overline{R}_i)} \times \sqrt{12} \qquad \text{................................ (6)}$$

$$\sigma_m = \sqrt{\frac{1}{T}\sum_{t=1}^{T}(R_{im} - \overline{R}_m)} \times \sqrt{12} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$\beta = \frac{Cov(R_i, R_m)}{\sigma_m^2} = \frac{\rho_{im} \times \sigma_i \times \sigma_m}{\sigma_m^2} = \frac{\rho_{im} \times \sigma_i}{\sigma_m} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where,

T = number of observation over the period from April 1996 to March 2006,

R_{it} , R_{im} = monthly return of mutual funds and the market index (S&P 500) respectively,

$\overline{R}_i$, $\overline{R}_m$ = average return of mutual funds and market index,

σ_i , σ_m = standard deviation of mutual fund and market index

ρ_{im} = correlation coefficient between mutual fund and market

Equation (6) and (7) provide annualized standard deviation of funds and market index. Equation (8) characterizes the equation used for calculating beta coefficient in Steele Mutual Fund Expert.

Performance Ratios:

$$\text{Sharpe Ratio} = \frac{AR_i - \overline{R}_f}{\sigma_i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Treynor Ratio= $\frac{AR_i - \overline{R}_f}{\beta_i}$ .....(10)

Jensen's alpha= $\alpha_i = R_i - (R_f + \beta_i \times (R_m - R_f))$ .....(11)

GH1= $AR_i - \left[\overline{R}_f + \frac{\sigma_i}{\sigma_m}\left(AR_m - \overline{R}_f\right)\right]$ .....(12)

GH2= $\left[\overline{R}_f + \frac{\sigma_m}{\sigma_i}\left(AR_i - \overline{R}_f\right)\right] - AR_m$ .....(13)

The equations, (9) through (13), are the equations used for calculating performance measurement as discussed in Chapter Two.

The annualized standard deviations (σ_i), and the beta coefficients (β) are used as measures of volatility. Calculating and comparing performance measurement, we rely on the annualized standard deviations (ASD) (σ_i), and the beta coefficients (β) in Steele Mutual Fund Expert.

According to Steele Expert Database, Beta (β) indicates the primary measure of market risk of an investment which can depend on various factors influencing the economy and financial markets in general. It measures the volatility of an investment relative to the overall equity market (S&P 500-Composite index) adjusted for distributions (i.e. assuming earned dividends are

reinvested.) Annualized Standard Deviation of each fund is computed by multiplying its monthly standard deviation by the square root of 12. It can be used with the annualized returns of various periods. Lastly, the alpha (α) which is also called as "residual return" is a risk-adjusted performance figure which measures the return of a fund resulting from taking selection risk.

Monthly return of fund (R_{it}) and monthly return of market indices, S&P500 Composite Index, (R_{mt}) is collected from Steele Mutual Fund Expert. Table-A in Appendix indicates the monthly return of S&P 500 over the period from April 1996 to March 2006. Both (R_{it}) and (R_{mt}) are annualized based on the formulas in equations (2) and (3). On the other hand, monthly T-bill rate of return (R_{ft}) is collected from official website of Board of Governors of Federal Reserve (www.federalreserve.gov). R_{ft} is annualized by using equation (1). Table-B-I and TABLE-B-II in Appendix also indicates risk free rate of 1-year, 3-year, 5-year and 10-year T-bills over the period from April 1996 to March 2006.

Average Risk Free ($\overline{R_{ft}}$) rate is based on each periods (i.e. for 1-year period, Market yield on U.S. Treasury

securities at 1-year constant maturity, quoted on investment basis is used.) for the calculations purpose.

The overall results of performance measurements are applied in each type of mutual fund class for 1-year, 3-year, 5-year, and 10-year period by comparing performance measurement.

CHAPTER FOUR

FINDINGS

This chapter provides data-analysis and provides the results. The chapter is organized as follows:

Firstly, Annualized Standard Deviation (ASD) of S&P 500 Composite Index (S&P 500) is analyzed assuming an investment horizon of 1-year, 3-year, 5-year and 10-year period. Secondly, the performance of each category of fund is evaluated for the respective investment horizons.

TABLE-C in Appendix depicts the overall market (S&P 500 Composite Index) performance for 1-year, 3-year, 5-year, and 10-year period. As is evident, the longer the time horizon, the higher is the ASD of S&P 500. ASD of S&P 500 is 6.93, 8.79, 13.98 and 15.62 for 1-year, 3-year, 5-year and 10-year respectively. Although one would expect that higher ASD (or risk) is compensated by higher return, the results indicate that the increase in risk for longer periods is not accompanied by proportional returns in those periods.

TABLE-C in Appendix also represents that the Annualized Return (AR) of highly volatile 5-year and 10-year periods are (4.98% and 9.91% respectively) lower than the Annualized Return of less volatile periods of

1-year and 3-year periods, (11.35% and 16.35% respectively).

TABLE-D depicts the overall result of different performance measurements. Results in this table indicate that Treynor's ratio and Jensen's alpha indicate positive performance for almost every category of mutual funds except for Money Market Mutual Funds. As against this, Sharpe, GH-1 and GH-2 yield same performance for every Mutual Fund Category for all periods. Sharpe, GH-1 and GH-2, demonstrate that Index, Asset and Money Market outperform the market index while Equity and Convertible underperform relative to the market index.

Results

Index Mutual Funds

In the well-diversified portfolios like index funds, Treynor ratio and Sharpe ratio are expected to yield similar result because, in theory, the Beta (β) of well diversified portfolio is equal to 1, indicating that all unsystematic risk is taken away. The standard deviation in Sharpe ratio of a well diversified portfolio (σ_i) is approximately same as the standard deviation of market index (σ_m). Therefore, the expected performance of these portfolios with respect to market index (S&P 500) is to

yield similar result and difference between Sharpe ratio and treynor should be close to zero. However, findings indicate that there is no such consistency between Treynor and Sharpe ratio in the index fund. The main reason for this inconsistency is that in index funds, the average beta is always different for all periods. Moreover, the annualized standard deviation of index funds is not same of even close to the annualized standard deviation of S&P 500. TABLE-E in Appendix depicts the average Beta (β) and average annualized standard deviation (ASD) of index funds.

TABLE-D (PANEL-I) shows that Sharpe Ratio, GH-1 and GH-2 are consistent showing negative performance for 1-year, 3-year, and 10-year period while positive performance for 5-year period. The plausible reason for positive performance of funds in 5-year period is higher volatility of S&P 500 and its lower annualized return. This market condition helps most of the funds beat S&P 500 in 5-year investment horizon. In index funds, moreover, Jensen's Alpha and Treynor represent the positive performance for all periods.

Equity Mutual Funds

The results indicate that Treynor's ratio, Sharpe ratio, Jensen's Alpha, GH-1 and GH-2 yield similar

performance (positive) for 1-year,3-year and 5-year but not for 10-year period. For 10-year period, however, Treynor, and Jensen's Alpha indicate positive result, while Sharpe, GH-1 and GH-2 offer negative performance result. The detailed results are depicted in TABLE-D (PANEL-II)

Asset Allocation Mutual Funds

Findings for Asset Allocation mutual funds are depicted in TABLE-D (PANEL-III). As shown in the table, all performance measurement indicates positive return in 5-year period. The reason for this is higher volatility of S&P 500 and, indeed, its lower annualized return for 5-year period. As mentioned earlier, this market condition helps most of the funds beat S&P 500 as index funds.

All performance measures indicate negative return in 10- year period consistently. However, Sharpe, GH-1 and GH-2 give negative performance suggesting investing in S&P 500 is better than investing in Asset Allocation funds for 1- and 3- year periods while Treynor and Jensen's alpha provide positive performance for the same periods.

Convertible Mutual Funds

Results show that Sharpe, GH-1 and GH-2 provide same performance advice for convertibles i.e., positive performance in 1- and 5- year period and negative return

in 3- and 10-year period. Treynor and Jenson's Alpha yield positive return in 1- and 5-year period as Sharpe, GH-1 and GH-2 do. However, unlike Sharpe, GH-1 and GH-2, Treynor and Jensen's Alpha give positive return in 3- and 10- year period. Detailed information is illustrated in TABLE-D (PANEL-IV)

Fixed Income Mutual Funds

Since these type mutual funds provide fixed income to investors, they are designed for investors reluctant to invest in fluctuating securities. Sharpe, GH-1 and GH-2 are consistent with each other for all 1-year, 3-year, 5-year and 10-year periods; their performances are negative in 1-year, 3-year, and 10-year period while positive in 5-year period. As explained above, the potential reason this last result, as explained above, is higher volatility of S&P 500 and, indeed, its lower annualized return for 5-year period. Jensen's Alpha indicates positive return both 3-year and 5-year period while negative in 1-year and 10-year period. On the other hand, Treynor indicates exactly opposite performance measurement to Sharpe, GH-1 and GH-2. Unlike, Sharpe, GH-1 and GH-2, Treynor demonstrates positive performance in 1-year, 3-year, and 10-year period while negative

performance in 5-year period. The detailed results are indicated in TABLE-D (PANEL-V) in Appendix

Money Market Mutual Funds

The last Panel, TABLE-D (PANEL-VI), indicates the results of performance measurement in Money Market Mutual Funds. Sharpe, Jensen's Alpha, GH-1 and GH-2 provide negative return for all periods.

CHAPTER FIVE

CONCLUSIONS

Using Steele Database, this thesis compares the performance of Treynor (1966), Sharpe (1966), Jensen (1968), GH-1 and GH-2 (1996). As stated previously, this database includes 19,700 mutual funds, their monthly returns, and standard deviations between 1962 and 2006.

A study of Mutual Fund Industry is an important endeavor. The industry reached more than $9 trillion in 2006. Moreover, more than 90% of the mutual funds in the industry consist of actively managed mutual funds indicating the importance of performance evaluation of fund managers. (www.answers.com)

To compare the predicting ability of those performance measures, we collected 5,987 different mutual funds from April 1996 to March 2006. These mutual funds have been divided according to the investment objectives most commonly used by professional money managers, namely: Index, Equity, Asset Allocation, Convertibles and Fixed Income Mutual Funds. Returns and annualized standard deviation of these mutual funds are obtained from Steele Mutual Fund Expert. Finally, we evaluate performance of

each category with respect to performance market index of S&P 500 Composite.

Findings are presented and summarized as follows:

Conclusions based on results of observations as follows:

- Treynor's Ratio and Jensen's Alpha lead to more optimistic results than Sharpe, GH-1 and GH-2 do. Treynor's Ratio and Jensen's Alpha provides exactly same performance result as Index, Equity and Convertible Mutual Funds for all investment horizons[5].
- When compared with performance of S&P 500, Treynor's Ratio and Jensen's Alpha confer exactly same performance (overperformance or underperformance S&P 500) for Index Funds, Equity Funds, Asset Funds and Convertible Mutual Funds for all horizon periods. This indicates that for positive beta, Treynor's Ratio and Jensen's Alpha yield same result. As shown in the body of this thesis, these findings are challenged when funds have negative Beta[6].
- Sharpe and GH-1 & GH-2 do not provide different performance result in any category of funds in 1-year, 3-year, 5-year, and 10-year periods when

the mutual funds are compared with S&P 500. Therefore, contrary to the claim that GH-1 and GH-1 are different from all traditional performance measurement, Sharpe Ratio yields same result as GH-1 and GH-2 give.

APPENDIX A

MONTHLY RETURN OF S&P 500 COMPOSITE INDEX

SP500 Composite Index - Monthly Return							
Mar-06	1.24	Sep-06	-1.06	Mar-06	-6.33	Sep-98	6.41
Feb-06	0.27	Aug-06	1.95	Feb-06	-9.11	Aug-98	-14.4
Jan-06	2.65	Jul-06	1.76	Jan-06	3.55	Jul-98	-1.06
Dec-06	0.04	Jun-06	1.28	Dec-00	0.49	Jun-98	4.06
Nov-06	3.78	May-06	5.26	Nov-00	-7.88	May-98	-1.72
Oct-06	-1.67	Apr-06	8.24	Oct-00	-0.42	Apr-98	1.01
Sep-06	0.81	Mar-06	0.96	Sep-00	-5.28	Mar-98	5.12
Aug-06	-0.91	Feb-06	-1.5	Aug-00	6.21	Feb-98	7.12
Jul-06	3.72	Jan-06	-2.61	Jul-00	-1.56	Jan-98	1.1
Jun-06	0.14	Dec-06	-5.87	Jun-00	2.47	Dec-97	1.72
May-06	3.18	Nov-06	5.88	May-00	-2.05	Nov-97	4.63
Apr-06	-1.9	Oct-06	8.79	Apr-00	-3.01	Oct-97	-3.34
Mar-06	-1.77	Sep-06	-10.9	Mar-00	9.78	Sep-97	5.47
Feb-06	2.1	Aug-06	0.65	Feb-00	-1.89	Aug-97	-5.6
Jan-06	-2.44	Jul-06	-7.79	Jan-00	-5.02	Jul-97	7.95
Dec-06	3.4	Jun-06	-7.12	Dec-99	5.89	Jun-97	4.48
Nov-06	4.05	May-06	-0.73	Nov-99	2.03	May-97	6.08
Oct-06	1.53	Apr-06	-6.06	Oct-99	6.33	Apr-97	5.96
Sep-06	1.08	Mar-06	3.76	Sep-99	-2.74	Mar-97	-4.1
Aug-06	0.4	Feb-06	-1.93	Aug-99	-0.5	Feb-97	0.79
Jul-06	-3.31	Jan-06	-1.46	Jul-99	-3.12	Jan-97	6.24
Jun-06	1.94	Dec-06	0.88	Jun-99	5.55	Dec-96	-1.98
May-06	1.37	Nov-06	7.67	May-99	-2.36	Nov-96	7.55
Apr-06	-1.57	Oct-06	1.91	Apr-99	3.87	Oct-96	2.76
Mar-06	-1.51	Sep-06	-8.07	Mar-99	4	Sep-96	5.62
Feb-06	1.39	Aug-06	-6.25	Feb-99	-3.11	Aug-96	2.11
Jan-06	1.84	Jul-06	-0.98	Jan-99	4.18	Jul-96	-4.42
Dec-06	5.24	Jun-06	-2.43	Dec-98	5.76	Jun-96	0.38
Nov-06	0.88	May-06	0.67	Nov-98	6.06	May-96	2.57
Oct-06	5.65	Apr-06	7.76	Oct-98	8.13	Apr-96	1.47

TABLE-A: Monthly Return of S&P 500 Composite Index

APPENDIX B

MONTHLY RISK FREE RATES FOR 1-YEAR, 3-YEAR, 5-YEAR AND 10-YEAR T-BILLS

U.S. Treasury securities					U.S. Treasury securities					U.S. Treasury securities				
Time Period	1-year	3-year	5-year	10-year	Time Period	1-year	3-year	5-year	10-year	Time Period	1-year	3-year	5-year	10-year
1995-01	7.05	7.66	7.76	7.78	1996-01	5.09	5.2	5.36	5.65	1997-01	5.61	6.16	6.33	6.58
1995-02	6.7	7.25	7.37	7.47	1996-02	4.94	5.14	5.38	5.81	1997-02	5.53	6.03	6.2	6.42
1995-03	6.43	6.89	7.05	7.2	1996-03	5.34	5.79	5.97	6.27	1997-03	5.8	6.38	6.54	6.69
1995-04	6.27	6.68	6.86	7.06	1996-04	5.54	6.11	6.3	6.51	1997-04	5.99	6.61	6.76	6.89
1995-05	6	6.27	6.41	6.63	1996-05	5.64	6.27	6.48	6.74	1997-05	5.87	6.42	6.57	6.71
1995-06	5.64	5.8	5.93	6.17	1996-06	5.81	6.49	6.69	6.91	1997-06	5.69	6.24	6.38	6.49
1995-07	5.59	5.89	6.01	6.28	1996-07	5.85	6.45	6.64	6.87	1997-07	5.54	6	6.12	6.22
1995-08	5.75	6.1	6.24	6.49	1996-08	5.67	6.21	6.39	6.64	1997-08	5.56	6.06	6.16	6.3
1995-09	5.62	5.89	6	6.2	1996-09	5.83	6.41	6.6	6.83	1997-09	5.52	5.98	6.11	6.21
1995-10	5.59	5.77	5.86	6.04	1996-10	5.55	6.08	6.27	6.53	1997-10	5.46	5.84	5.93	6.03
1995-11	5.43	5.57	5.69	5.93	1996-11	5.42	5.82	5.97	6.2	1997-11	5.46	5.76	5.8	5.88
1995-12	5.31	5.39	5.51	5.71	1996-12	5.47	5.91	6.07	6.3	1997-12	5.53	5.74	5.77	5.81
1998-01	5.24	5.38	5.42	5.54	1999-01	4.51	4.61	4.6	4.72	2000-01	6.12	6.49	6.58	6.66
1998-02	5.31	5.43	5.49	5.57	1999-02	4.7	4.9	4.91	5	2000-02	6.22	6.65	6.68	6.52
1998-03	5.39	5.57	5.61	5.65	1999-03	4.78	5.11	5.14	5.23	2000-03	6.22	6.53	6.5	6.26
1998-04	5.38	5.58	5.61	5.64	1999-04	4.69	5.03	5.08	5.18	2000-04	6.15	6.36	6.26	5.99
1998-05	5.44	5.61	5.63	5.65	1999-05	4.85	5.33	5.44	5.54	2000-05	6.33	6.77	6.69	6.44
1998-06	5.41	5.52	5.52	5.5	1999-06	5.1	5.7	5.81	5.9	2000-06	6.17	6.43	6.3	6.1
1998-07	5.36	5.47	5.46	5.46	1999-07	5.03	5.62	5.68	5.79	2000-07	6.08	6.28	6.18	6.05
1998-08	5.21	5.24	5.27	5.34	1999-08	5.2	5.77	5.84	5.94	2000-08	6.18	6.17	6.06	5.83
1998-09	4.71	4.62	4.62	4.81	1999-09	5.25	5.75	5.8	5.92	2000-09	6.13	6.02	5.93	5.8
1998-10	4.12	4.18	4.18	4.53	1999-10	5.43	5.94	6.03	6.11	2000-10	6.01	5.85	5.78	5.74
1998-11	4.53	4.57	4.54	4.83	1999-11	5.55	5.92	5.97	6.03	2000-11	6.09	5.79	5.7	5.72
1998-12	4.52	4.48	4.45	4.65	1999-12	5.84	6.14	6.19	6.28	2000-12	5.6	5.26	5.17	5.24

TABLE-B-I: Monthly Risk Free Rates for 1-year, 3-year, 5-year and 10-year T-bills

U.S. Treasury securities				
Time Period	1-year	3-year	5-year	10-year
2001-01	4.81	4.77	4.86	5.16
2001-02	4.68	4.71	4.89	5.1
2001-03	4.3	4.43	4.64	4.89
2001-04	3.98	4.42	4.76	5.14
2001-05	3.78	4.51	4.93	5.39
2001-06	3.58	4.35	4.81	5.28
2001-07	3.62	4.31	4.76	5.24
2001-08	3.47	4.04	4.57	4.97
2001-09	2.82	3.45	4.12	4.73
2001-10	2.33	3.14	3.91	4.57
2001-11	2.18	3.22	3.97	4.65
2001-12	2.22	3.62	4.39	5.09
2004-01	1.24	2.27	3.12	4.15
2004-02	1.24	2.25	3.07	4.08
2004-03	1.19	2	2.79	3.83
2004-04	1.43	2.57	3.39	4.35
2004-05	1.78	3.1	3.85	4.72
2004-06	2.12	3.26	3.93	4.73
2004-07	2.1	3.05	3.69	4.5
2004-08	2.02	2.88	3.47	4.28
2004-09	2.12	2.83	3.36	4.13
2004-10	2.23	2.85	3.35	4.1
2004-11	2.5	3.09	3.53	4.19
2004-12	2.67	3.21	3.6	4.23

U.S. Treasury securities				
Time Period	1-year	3-year	5-year	10-year
2002-01	2.16	3.56	4.34	5.04
2002-02	2.23	3.55	4.3	4.91
2002-03	2.57	4.14	4.74	5.28
2002-04	2.48	4.01	4.65	5.21
2002-05	2.35	3.8	4.49	5.16
2002-06	2.2	3.49	4.19	4.93
2002-07	1.96	3.01	3.81	4.65
2002-08	1.76	2.52	3.29	4.26
2002-09	1.72	2.32	2.94	3.87
2002-10	1.65	2.25	2.95	3.94
2002-11	1.49	2.32	3.05	4.05
2002-12	1.45	2.23	3.03	4.03
2005-01	2.86	3.39	3.71	4.22
2005-02	3.03	3.54	3.77	4.17
2005-03	3.3	3.91	4.17	4.5
2005-04	3.32	3.79	4	4.34
2005-05	3.33	3.72	3.85	4.14
2005-06	3.36	3.69	3.77	4
2005-07	3.64	3.91	3.98	4.18
2005-08	3.87	4.08	4.12	4.26
2005-09	3.85	3.96	4.01	4.2
2005-10	4.18	4.29	4.33	4.46
2005-11	4.33	4.43	4.45	4.54
2005-12	4.35	4.39	4.39	4.47

U.S. Treasury securities				
Time Period	1-year	3-year	5-year	10-year
2003-01	1.36	2.18	3.05	4.05
2003-02	1.3	2.05	2.9	3.9
2003-03	1.24	1.98	2.78	3.81
2003-04	1.27	2.06	2.93	3.96
2003-05	1.18	1.75	2.52	3.57
2003-06	1.01	1.51	2.27	3.33
2003-07	1.12	1.93	2.87	3.98
2003-08	1.31	2.44	3.37	4.45
2003-09	1.24	2.23	3.18	4.27
2003-10	1.25	2.26	3.19	4.29
2003-11	1.34	2.45	3.29	4.3
2003-12	1.31	2.44	3.27	4.27
2006-01	4.45	4.35	4.35	4.42
2006-02	4.68	4.64	4.57	4.57
2006-03	4.77	4.74	4.72	4.72

TABLE-B-II: Monthly Risk Free Rates for 1-year, 3-year, 5-year and 10-year T-bills

APPENDIX C

ANNUALIZED RETURN AND ANNUALIZED STANDARD DEVIATION OF S&P500

Annualized Return of S&P 500	
1-year	11.35
3-year	16.35
5-year	4.86
10-year	9.82
Annualized Standard Deviation of S&P 500	
1-year	6.93
3-year	8.79
5-year	13.98
10-year	15.62

TABLE-C: Annualized Return & Annualized Standard Deviation of S&P500

APPENDIX D

AGGREGATE RESULTS OF PERFORMANCE MEASURES PER CATEGORY PER INVESTMENT PERIOD

PANEL I		Treynor	Sharpe	Jensen	GH-1	GH-2
index	1-year	11.22	-2.30	2.77	-0.35	-15.95
	3-year	12.02	-1.73	2.31	-2.37	-15.25
	5-year	2.64	0.097	3.30	2.26	1.36
	10-year	7.24	-1.09	0.43	-0.75	-17.06
PANEL II		Treynor	Sharpe	Jensen	GH-1	GH-2
equity	1-year	3.14	0.26	6.24	3.49	1.84
	3-year	4.37	0.05	4.22	0.53	0.50
	5-year	5.73	0.21	3.92	3.71	3.00
	10-year	1.80	-0.01	0.93	-0.43	-0.18
PANEL III		Treynor	Sharpe	Jensen	GH-1	GH-2
asset	1-year	0.58	-0.17	0.41	-0.79	-1.21
	3-year	0.57	-0.21	0.38	-1.33	-1.84
	5-year	2.83	0.06	0.68	0.56	0.91
	10-year	-0.47	-0.09	-0.29	-0.93	-1.40
PANEL IV		Treynor	Sharpe	Jensen	GH-1	GH-2
convertible	1-year	2.36	0.025097	1.92	0.25	0.17
	3-year	0.38	-0.23	0.34	-1.79	-2.07
	5-year	4.02	0.21	2.32	2.18	3.01
	10-year	1.78	-0.001	0.96	-0.06	-0.01
PANEL V		Treynor	Sharpe	Jensen	GH-1	GH-2
fixed income	1-year	9.72	-1.64	-0.60	-3.76223	-11.42
	3-year	12.35	-1.52	0.06	-5.35	-13.39
	5-year	-0.96	0.01	0.85	0.44	0.13
	10-year	13.03	-0.42	-0.21	-1.34	-6.61
PANEL VI		Treynor	Sharpe	Jensen	GH-1	GH-2
money market	1-year	-1.36	-11.45	-1.24	-1.40	-79.36
	3-year	136.52	-7.63	-1.62	-2.14	-67.07
	5-year	N/M	-7.95	-2.19	-2.21	-111.26
	10-year	N/M	-5.95	-2.30	-2.44	-92.95

TABLE-D: Aggregate Results of Performance Measures per category per investment period.

APPENDIX E

TABLE-E: AVERAGE ANNUALIZED STANDARD DEVIATION OF INDEX FUNDS, ANNUALIZED STANDARD DEVIATION OF S&P500 AND BETA OF INDEX FUNDS

	1-year	3-year	5-year	10-year
ASD of Index Funds	6.11	7.02	9.97	9.62
ASD of S&P 500	6.93	8.79	13.98	15.62
Beta of Index	0.45	0.44	0.34	0.35

TABLE-E: Average Annualized Standard Deviation of Index Funds, Annualized Standard Deviation of S&P 500 and Beta of Index Funds

APPENDIX F

TABLE-F: AVERAGE BETA PER CATEGORY AND PER YEAR

	Average Beta per Category and per Year			
	1-year	3-year	5-year	10-year
Index	0.455559	0.444381	0.341903	0.356314
Equity	1.23214	1.103199	0.983104	0.915543
Asset	0.591818	0.614353	0.533333	0.526501
Convertibles	9.704873	13.5855	5.140269	6.348736
Fixed	-0.05667	0.037679	-0.06969	0.007758
Money Market	-0.00003	-0.00485	0	0

TABLE-F: Average Beta per Category and per Year

ENDNOTES

1. ETFs, or exchange-traded funds, are investment companies with shares that trade on the stock exchange. The shares are based on a basket of underlying stock that usually mirrors an index. The shares act much like equity shares and can trade at a premium or discount compared to their net asset value because of supply and demand factors.

2. For both individual and market averages, rate of return is computed by the dividing the sum of return is computed by dividing the sum of the dividends, interest, and market appreciation on the funds available at the beginning of the year by the value of the funds available at the beginning of the year. Any increase in asset value during the year due to infusion of new funds eliminated, as is any reduction due to distributions to beneficiaries or shareholders. Rates of return defined in this way are obviously approximations, because the value of funds available for investment typically fluctuates more or less continuously throughout the year

3. "Liquidity Preference as Behavior towards Risk" Review of Economic Studies, XXV (February, 1958), 65-86

4. http://www.cupoffinance.com/invest/mf/mf_riskadjreturn.shtml

5. According to TABLE-F in Appendix, there are 24 observations calculated for each performance metric for all categories in 1-year, 3-year, 5-year and 10-year periods. Overall, Treynor's ratio presents 19 (79.16%) positive performance observations while only 5 (20.83%) of which are negative. Similarly, Jensen's Alpha offers 17 (70.83%) positive performances out of 24 observations. On the other hand, Sharpe, GH-1 and GH-2 display 8 (33.33%) positive observations out of 24 observations.

6. Negative Beta causes Treynor's Ratio and Jensen's Alpha to lead to opposite results of performance. TABLE-F in Appendix illustrates average Beta per category per year. For example, since the average Beta is negative in Fixed Income in 1-year and 5-

year, Treynor's Ratio and Jensen's Alpha indicate opposite performance.
Thus, one can conclude that negative Beta may carry misleading performance information about particular funds. Even if a mutual fund provides positive performance, according to Treynor Ratio, the negative beta based on historical observation make performance of this fund unattractive.
Only one exception can be seen in TABLE-F in Appendix. Although the average beta of Fixed Income-10 year is positive, Treynor and Jensen still indicate opposite performance. The reason of this result is the problem of average calculations. There are 2,159 observation obtained from Steele Mutual Funds Expert. The number of negative beta is 1,640 ranging from -0.01 to -0.09. On the other hand, the number of positive beta is 364 ranging from 0.01 to 0.74. (the remaining 155 observation has "0" beta). Although the negative beta dominant in this particular period, the average, because of positive beta's higher range, is positive.

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